

# DD(X) Human-Systems Integration: Processes and Metrics

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**NORTHROP GRUMMAN**  
*Ship Systems*

**Raytheon**

Undersea HSI Symposium

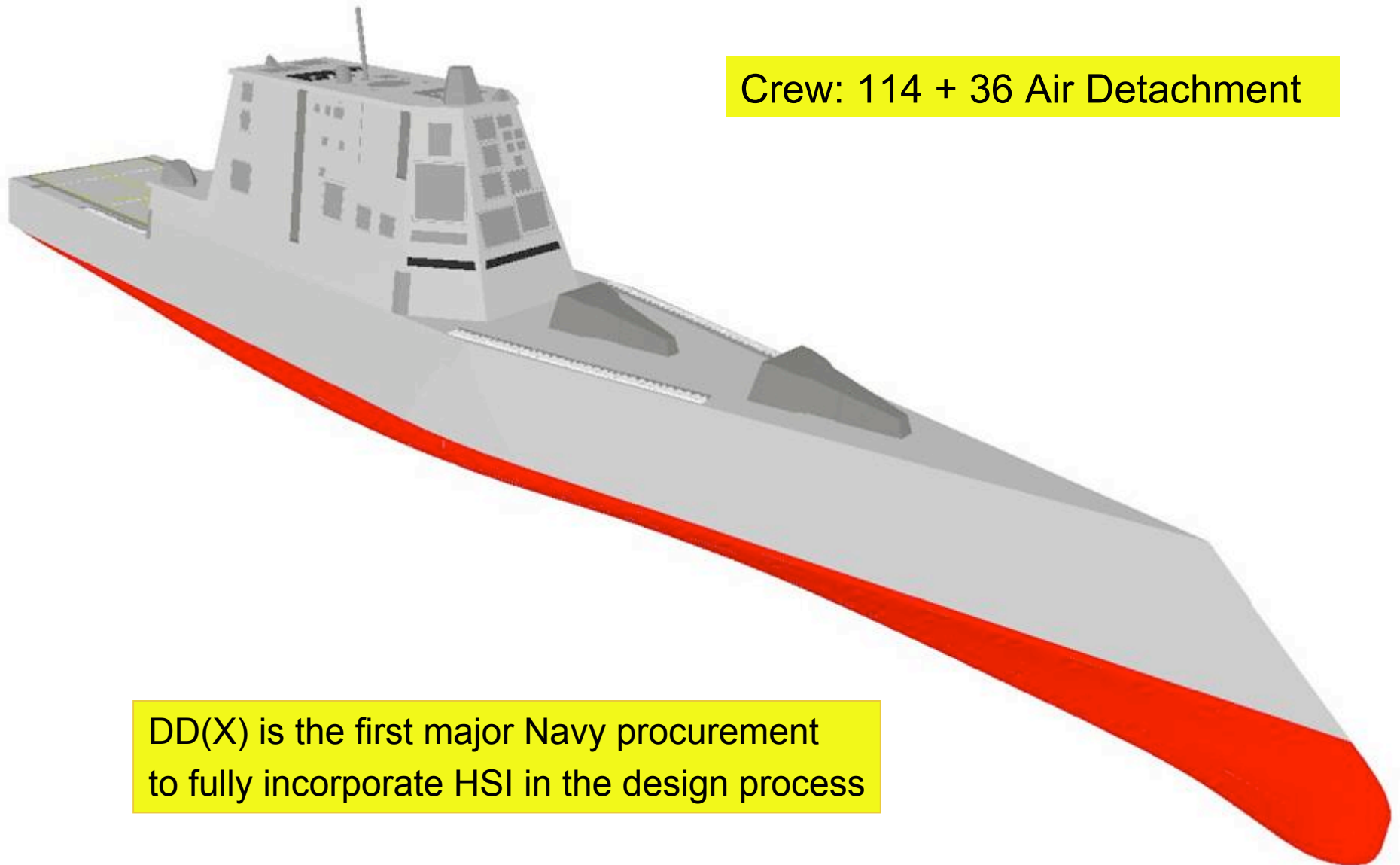
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# Ship Overview

Crew: 114 + 36 Air Detachment



DD(X) is the first major Navy procurement to fully incorporate HSI in the design process

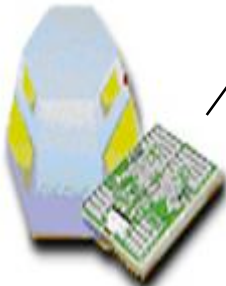


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# DD(X) Transformational Systems

## Dual Band Radar *Detection of Stealthy Targets in Sea-land Clutter*

- ♦ Multi-Function Radar
- ♦ Volume Search Radar



## Integrated Composite Deckhouse & Apertures *Multi-Spectral Stealth Signatures*

- ♦ Low RCS / IR / EO Signatures
- ♦ Planar Array Antennas



## Advanced Vertical Launch System (AVLS) *Next Generation Launch System*

- ♦ Tomahawk
- ♦ Standard Missile (SM 2)
- ♦ Evolved Sea Sparrow Missile (ESSM)



## Advanced Gun System (AGS) *Surface Volume Fires*

- ♦ Automated Magazine
- ♦ Up to 100 mile Land Attack Projectile



## Total Ship Computing Environment (TSCE) *Reduced Crew, Open Architecture*

- ♦ Substantially Reduced Manning
- ♦ Fully Integrated Combat System
- ♦ Network Centric Operations
- ♦ Organic Targeting



## Integrated Power System (IPS) *Increased Operational and Design Flexibility*

- ♦ LM2500 & LM500 Gas Turbines
- ♦ 2 Fixed Pitch Propellers
- ♦ Permanent Magnet In-Hull Motors

## Hull & Mobility *Improved Survivability*

- ♦ Hybrid Double Hull
- ♦ 30 kt Sustained Speed
- ♦ Hangar both Helos & UAVs
- ♦ Two Flight Deck Spots
- ♦ Stern Boat Launch



## Integrated Undersea Warfare *In-Stride Mine Avoidance*

- ♦ Dual Freq Sonar Bow Array
- ♦ Multi-Function Towed Array (MFTA)
- ♦ Torpedo Countermeasures

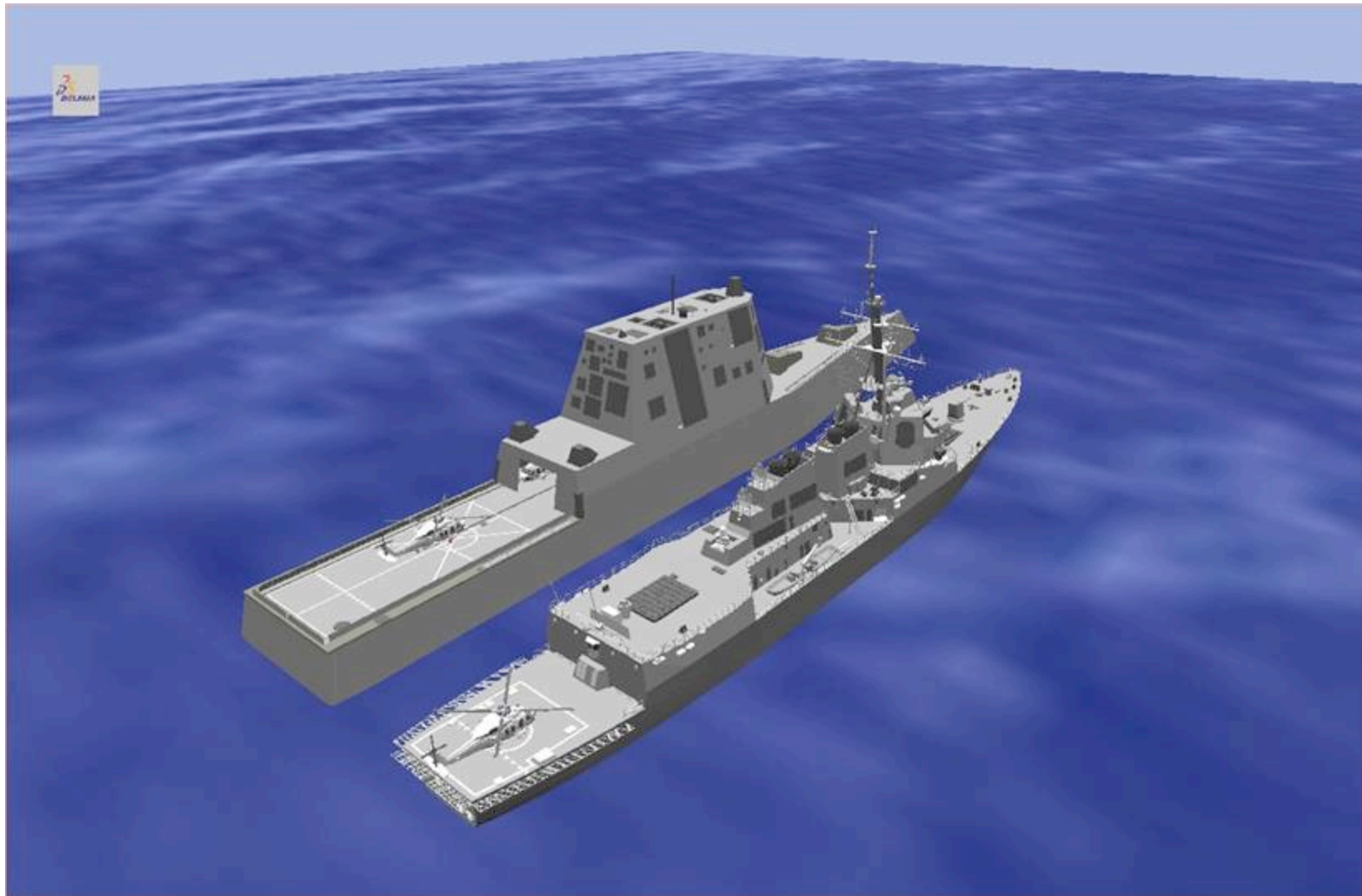
## AFSS *Combines Automation, Controls and Manning*





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# DD(X)/DDG-51 Flt IIA Comparison

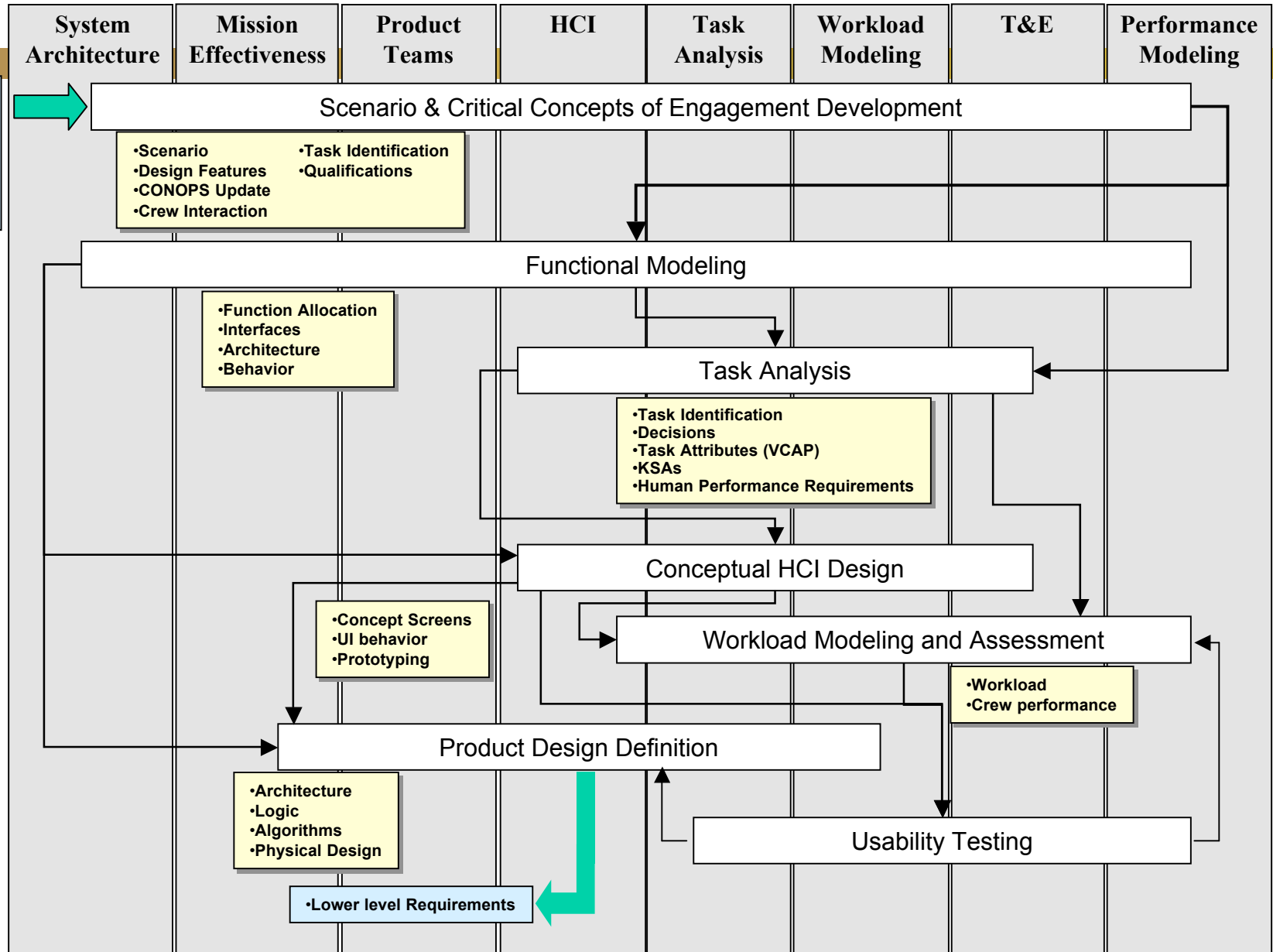




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# Combined HSI/Systems Engineering Analysis Methodology

- Requirements
- Design Features
- CONOPS
- Manning Concept
- Fleet Tactics
- Qualifications
- System Use Cases





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## Potential DD(X) HSI Metrics

- Requirements
  - The number and criticality of requirements generated or significantly impacted by HSI is the bottom-line measure of HSI's impact on the design of DD(X).
    - Human-system performance, training, KSAs, quality of shipboard life, etc.
- Test events impacted by HSI
- Program risks impacted by HSI

Not always easy to tease out the unique contribution of HSI, because if we're doing our job right, we're fully integrated with the rest of the program

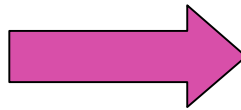


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## Conclusion – The Ultimate Metric



Prehistoric  
HSI



Modern  
HSI

HSI's success and impact will be largely determined by its level of *seamless transparency and connectivity* with respect to all other systems engineering disciplines